

EFFECT OF NITROGENOUS FERTILIZERS AND AGRICULTURAL SULFUR ADDITION ON RELEASE OF CALCIUM AND MAGNESIUM IN SOME OF IRAQI CALCAREOUS SOILS

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ABSTRACT

To study the effect of the addition of N-fertilizer (Urea and DAP) and Agricultural sulfur on release of Ca^{++} and Mg^{++} in some of calcareous soils for Wasit city, Two different locations are chosen in the texture with depth (0-30 cm) were AL-Nuamania and AL-Hay, the fertilizers above were used with two method (Miscible displacement and Batch Equilibrium) and with four time period (15,30,45 and 60 min).

The results showed that treatments were arranged according to its ability on release of calcium with miscible displacement method as follow:

Agri-S > DAP > Urea > Control, and took the same arrangement concerning of magnesium.

The results showed that treatments were arranged according to its ability on release of calcium with Batch Equilibrium method as follow :

Agri-S > DAP > Urea > Control, and took the same arrangement concerning of magnesium.

The release amount from calcium and magnesium with miscible displacement method were taken with the decrease with the time period compared with Batch Equilibrium method which took with the increase with the time period and with significant differences between the two methods, and these the increase or the decrease in the release amounts for the two elements were depend on the period time, method of extraction, type of treatment, texture of soil, type of soil and other physical and chemical properties.

KEYWORDS: Batch Equilibrium Method, Physical and Chemical Properties, Method of Extraction

INTRODUCTION

Calcium and Magnesium are considered from the necessary and important elements for the plant growth ,they are present in soil with different phases such as the adsorbed phase on surfaces of soil colloids and the precipitated phase which characterize by very low solubility within soil minerals or in different chemical compounds and the soluble form which result about the different salts hydration the ability to the soluble with quick in the water ,in solutions of natural lands were the soluble calcium is form in extracts of soil more rate between

- Wasit university-college of agriculture-soil science department the different cations then magnesium ,while in the

salt effected lands the calcium and magnesium are not form but less rate between the present cations in water solutions for these lands (Page et al ;1982)

The range is located in the saturation water solution for land concerning to calcium concentration between about (0.1 - 10 meq/L⁻¹) while magnesium concentration between about (0.2 - 5 meq/L⁻¹).these concentrations are consider suitable for most of the plants, and believe the concentration which increase about (30 meq/L⁻¹) from solutions of saturation water soil is high or increase about of plant need (Page et al ;1982)

Improves of soil were use for increasing availability some of nutrients elements in soil ,and improvements some its properties for purpose increasing its productivity such, addition of ammonium nitrogenous fertilizers, organic fertilizers, agricultural sulfur, sulfuric acid and phosphoric gypsum, using of sulfuric acid in agriculture is consider advance step compared with agricultural sulfur from where the time, were reduce of sulfur oxidative period then transform to sulfuric acid (Ryan et al; 1974) (Miyanoto and Stroehelin;1986) (Saleh et al;1989). Addition of ammonium for the soils as result for its oxidative was result about its increasing of hydrogen ion which participate in supply of calcium from calcium carbonate:



To purpose knowledge relation of ammonium nitrogenous fertilizers (Urea, DAP) and agricultural sulfur on release of calcium and magnesium in calcareous soil was conducted this research.

Materials and Methods

Selection of the Locations

Two different locations was chosen from Wasit city/Iraq on the difference essential in soil texture with depth (0-30 cm), these location are: Al-Nuamania and Al-Hay, some its properties show that in (table 1).the experiments was designed with CRD ,and used less significant difference (LSD/0.05) for comparing of the treatments moderate, some of chemical and physical properties was determined with (Page et al;1982)method.

Release of Calcium and Magnesium in the Soil

Series from the different laboratories experiments were conducted for studying solutions ability on calcium and magnesium release in soil with two methods were Miscible displacement method and Batch Equilibrium method .

Table 1: Some of Physical and Chemical Properties for Soil Study

Location	PH 1:1	EC 1:1 dis.m ⁻¹	Soil Separations (gm.kg ⁻¹)			Texture	CEC C.mol.k g	Soluble ions (meq.L ⁻¹)		CaCO ₃ gm.kg ⁻¹
			clay	sand	silt			Ca ⁺⁺	Mg ⁺⁺	
AL-Hai	7.90	1.60	210	640	140	Sandy clay loam	19	22	16	325
AL-Nuamaniya	7.80	1.00	320	250	420	Clay loam	29	20	12	295

Release of Calcium and Magnesium in Soil with Miscible Displacement Method

Glass columns were used with length (20cm) and with half diameter (5cm),where put glass wool below the column, then put of soil sample with amount (100gm) dry soil from each locate ,then good mixed with (5gm) fertilizer for each Urea, DAP and Agricultural sulfur after solved its for first ,second ,third treatments respectively, and soil without fertilizer as Control treatment .then allow to the fresh water with quite pass through of soil (1ml/minute) (Martin and Spark; 1985) by the keep on height of water column over soil surface (5cm).After that took the extractions solutions on four time periods, period of the one (15minute),with total duration (60 minutes). Ca⁺⁺ and Mg⁺⁺ were

determined in extractions solutions by titration with EDTA.

Release of Calcium and Magnesium in Soil with Batch Equilibrium Method

In this experiment (100 gm) dry soil put in volumetric beaker its capacity (1000ml),then good mixed with (5gm) fertilizer for each Urea, DAP and Agricultural sulfur after solved its for first ,second ,third treatments respectively, and soil without fertilizer as Control treatment ,and added for its (500 ml) fresh water (Spark;1980) and cool its without shake, in order to reach to equilibrium state, after that took the extractions solutions on four time periods, period of the one (15minute),with total duration (60 minutes). Ca^{++} and Mg^{++} were determined in extractions solutions by titration with EDTA .

RESULTS AND DISCUSSIONS

Effect of N-Fertilizers and Agri-S Addition on Ca^{++} and Mg^{++} Release in Soil with Miscible Displacement Method

Table 2 shows that the release amount from Ca^{++} and Mg^{++} , were differed between the two calcareous soils, where recorded more the release amount from AL-Nuamaniya location for all the treatments compared with location of Al-Hay soil, this difference return to increase of loam amount (420 gm.kg^{-1}) which the cause for increasing of CEC

Table 2: Effect of N-Fertilizers Addition and Agricultural Sulfur on Calcium and Magnesium Release(Meq/L)in Soil by Missible Displacement Method

Treatments	Location	Extraction Periods (Min)							
		15		30		45		60	
		Ca	Mg	Ca	Mg	Ca	Mg	Ca	Mg
Control	Al-Hay	4.50	9.56	3.10	6.70	2.20	4.90	1.70	4.60
	Al- Numaniya	6.00	13.00	4.00	10.90	2.90	6.00	2.00	5.00
Urea	Al-Hay	5.50	10.50	3.50	10.00	2.80	6.50	1.80	5.30
	Al- Numaniya	4.90	14.00	3.80	11.20	2.50	7.50	2.00	7.00
DAP	Al-Hay	8.20	12.80	7.20	10.50	5.80	7.60	4.00	3.10
	Al- Numaniya	10.00	17.30	7.80	13.20	6.00	9.22	5.00	5.40
Agri-S	Al-Hay	10.30	15.63	9.00	12.50	7.00	9.11	5.50	7.20
	Al- Numaniya	12.20	19.63	10.00	16.20	9.11	13.00	7.23	9.82
L.S.D/0.05									

(29`centi mol.kg⁻¹)and decrease of the sands (250 gm.kg^{-1}) in AL-Nuamaniya compared with AL-Hay soil which characterized by increase of sands amount (640 gm.kg^{-1}) which the cause to decrease of CEC (19 centi mol.kg⁻¹) for all the extraction periods.

May be arrangement of treatments according to ability on calcium release with miscible displacement for the two soils for the periods (15, 30, 45, 60) minutes as follow:

Agri-S > DAP > Urea > Control.

The arrangement above refers to Urea addition caused an significant increasing in amount of the release calcium for both the two soils compared with control treatment in results of the statistical analyses, this increasing in the release amount return to ammonium addition which its source Urea to the soils and result for its oxidation is cause increasing of hydrogen ion which participate in available of calcium from calcium carbonate (Larsen and Widdowson;1968), and took the same arrangement for the magnesium.

Table (2) shows that the release amount from calcium and magnesium by DAP fertilizer is better when compared with Urea and Control treatment with significant differences because addition of di-ammonium which its source DAP fertilizer which characterize with high polarity and ionic radius (1.43 Å) where give it's the ability on displace of calcium and magnesium according to bases of cationic exchangeable and increasing of (H^+) in calcareous soils

(Larsen and Widdowsen;1968) (Marten and Spark ;1983) (Handal and Pasrich;1993). Table (2) shows that significant increasing in release of calcium and magnesium for both the two soils for all the time periods at using the agricultural sulfur compared with other treatments this the increase return to the acidic effect for sulfur which cause for decreasing for each soil reaction (PH)and rate of CaCO_3 , this effect is increasing from availability of the nutrients minerals in soil as the Ca^{++} and Mg^{++} (Rayan et al;1974) (Miyamoto and Stoechelim;1986) (Salih et al;1989) (AL-Salmani et al;1998).

Table(2) shows that the release amount from calcium and magnesium for both the two soils were decreased with the time for all the use extractions in the study, where in the first time periods (15 min) were amore then decrease gradually concerning in the final time periods (60 min),these results led us to the conclusion: the release amount from the nutrients minerals differed with difference of time period within method of the one extraction for the same soil, while the difference was big at using more from one soil for difference chemical ,physical and mineralogical properties (AL-Aidy ;2004) .

Effect of N-Fertilizers and Agri-S Addition on Ca^{++} and Mg^{++} Release in Soil with Batch Equilibrium Method

Table (3) refer to amount of Ca^{++} and Mg^{++} release by Batch Equilibrium method which took with increasing with the time period for both the two soils (AL –Nuamaniya, AL-Hay) in all the use treatments in the study compared with miscible displacement method (table 2) which took with the decreasing with the time period .

may be arrangement of the treatments according to its ability on release of Ca^{++} and Mg^{++} by Batch Equilibrium for time of extraction(15,30,45,60 min) (table3) as follow :

Table (3) effect of N-fertilizers addition and agricultural sulfur on calcium and magnesium release(meq/L^{-1}) in soil by Batch Equilibrium method

Agri-S > DAP > Urea > Control .

Table 3

Treatment s	Location	Extraction Periods (Min)							
		15		30		45		60	
		Ca^{++}	Mg^{++}	Ca^{++}	Mg^{++}	Ca^{++}	Mg^{++}	Ca^{++}	Mg^{++}
Control	Al-Hay	2.20	7.60	3.20	8.20	4.00	8.80	4.50	9.00
	Al-Numaniya	2.20	5.90	2.80	6.30	3.30	7.30	4.10	8.20
Urea	Al-Hay	2.82	8.20	4.30	9.00	5.63	9.70	6.72	10.00
	Al-Numaniya	2.30	6.50	3.30	7.02	4.26	7.70	5.23	8.40
DAP	Al-Hay	4.89	13.33	8.84	16.11	12.24	18.33	15.00	19.22
	Al-Numaniya	4.20	9.00	6.70	11.00	9.22	13.20	10.11	14.00
Agri-S	Al-Hay	5.33	13.89	9.22	19.00	12.75	21.21	18.23	23.00
	Al-Numaniya	4.88	9.73	7.00	14.21	10.00	16.11	13.20	18.88
L.S.D/0.05									

From the arrangement above show the treatments were took same arrangement in miscible displacement method,these results return to the same reasons in (table 2).Results of the statistical analysis showed to presense significant difference between the release amount from calcium and magnesium by miscible displacement method (table 2) and the release amount from calcium and magnesium by Batch Equilibrium method (table 3),this insured (AL-Aidy;2004).

These results from the four treatments by the two methods for both the two soils led us to the conclusion: using of N-fertilizers (DAP and Urea) and agricultural sulfur were increase from calcium and magnesium in the calcareous soils as Wassit city soils, but this increasing for the release amount for the two elements (Ca^{++} and Mg^{++}) were different with difference of period time, method of extraction ,type of the treatment ,texture of soil and other physical and chemical properties.

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